Minimally Invasive Le Fort I Osteotomy Versus Traditional Technique (Prospective Case control clinical study)

Original Article

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ABSTRACT

Purpose: In this study, we compare endoscopic-assisted minimally invasive Lef1with the traditional approach in term of operation time and blood loss between the two procedures. Patients and Methods: This study is a prospective case-control study involving 16 patients divided into two groups: Group 1 (control group) underwent the traditional Le Fort I osteotomy, while Group 2 (study group) received a minimally invasive, endoscopic-assisted Le Fort I osteotomy. Results: There was a statistically significant difference between the two groups. Group 1 had greater blood loss (395 ± 69.28 mL) compared to Group 2 (301.25 ± 48.53 mL; p = 0.007). On contrast, the operation time was significantly shorter in Group 1 (160 ± 22.6 minutes) than in Group 2 (190 ± 30.23 minutes; p = 0.041). Conclusion:The minimally invasive approach is more effective in reducing blood loss compared to the traditional approach. However, it requires more operation time. Abbreviation: Minimally Invasive, Endoscopic-assisted Lefort 1(MILF1).Le Fort 1(lef1).

Key Words : Lefort I osteotomy, orthognathic surgery, minimally invasive

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INTRODUCTION

Obwegeser first popularized the Lef1 technique for its ability to reposition the maxilla in all three spatial dimensions, and since then it has been used to safely and reliably correct a wide range of maxillary and dental deformities.[1]. Effective mobilization of the maxilla in a Lef1 hinges on a precise separation from the sphenoid bone's pterygoid processes; this clear disjunction is essential to minimize neurovascular injury and prevent potential skull-base fractures.[2]. In skilled hands, Lef1 has become a safe, reliable, and predictable procedure, with the advent of specialized surgical instruments, deeper understanding of its biological healing processes, and optimized anesthetic techniques significantly reducing both its morbidity and operative time[3, 4]. Despite ongoing refinements, literature has documented several complications associated with the lef1,such as hemorrhage, hematoma, infection ,growth disturbances, and maxillary necrosis.Some authors have also reported tooth or segmental loss particularly in the anterior maxilla attributed to diminished vascular supply.[5],[6,7]. Endoscope-assisted techniques have become integral across numerous surgical specialties. The implications of endoscope in orthognathic surgery in combination with the conservative surgical approach and uses of piezoelectric device developed the term "minimally invasive orthognathic surgery"[8, 9]. Troulis and colleagues detailed an endoscopic vertical ramus osteotomy with subsequent rigid fixation for mandibular prognathism. However, only a handful of publications have explored endoscopic methods for midface procedures and Lef1 orthognathic surgery.[10-12]. In this study, we compare the traditional Lef1 with the MILF1 in terms of operation time and blood loss in each procedure. Using

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endoscope with the piezoelectric device is expected to reduce the need for large incisions, helping to preserve the maxillary blood supply and thus minimizing the risk of bone necrosis. Additionally, it provides superior visualization during the pterygomaxillary separation, reducing the likelihood of complications at this crucial step.

Patients and Methods:

This study is a prospective case-control study involving patients with skeletal jaw deformities who required Lef1 to correct their skeletal jaw relationships. The patients were divided equally into two groups: Group 1 (control group) underwent the traditional Lef1, while Group 2 (study group) received MILF1. The inclusion criteria consisted of patients diagnosed with skeletal jaw deformities who were candidates for Lef1 orthognathic surgery, with or without accompanying mandibular correction. The selected patients were between 20 and 35 years of age and included both genders. We excluded from this study any medically compromised patient's incompetent to undergo surgery, patients with minor jaw deformities correctable by orthodontic appliances, and growing patients younger than twenty. All procedures were fully explained in detail to each patient. A detailed informed consent (in accordance with the standard consent of the ethical committee of the Faculty of Dentistry, Minia University) was signed by all patient who agreed to participate in the study.

Surgical procedures:-

The surgical procedure was operated under GA with controlled hypotension. In Group 1 (control group) traditional lef1 : An incision was made in the maxillary buccal sulcus using a No. 15 blade or a diathermy knife. The incision was initiated at the buttress area and extended toward the midline, ensuring that approximately 5 mm of non-keratinized mucosa remained on the alveolar side for easier suturing later. For the osteotomy, a reciprocating saw (S8R) from W&H Germany was used, equipped with a 20 mm blade and connected to a surgical motor running at 30,000 rpm. The osteotomy was performed starting from the marked point on the lateral nasal wall, progressing through the lateral maxillary wall, and rotating posteriorly around the posterior maxillary wall. Continuous irrigation with 0.9% saline was maintained using a 16-gauge needle attached to a 50 ml plastic syringe, ensuring copious saline flow throughout the procedure. Group 2 (study group) received MILF1. A rigid 2.7mm diameter, 30° angle endoscope was used, connected to a video system that included a camera, light source, and monitor. Using a minimally invasive approach, an incision was made in the maxillary labial sulcus, extending from the right canine to the midline and continuing to the left canine with a No. 15 blade or diathermy knife(fig.1).

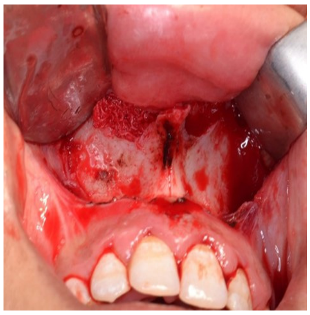

Fig. 1 Minimally invasive incision

Approximately 5 mm of non-keratinized mucosa was left on the alveolar side to facilitate suturing later. A V-shaped incision was made at the labial frenum to assist with proper position during closure. The osteotomy done with piezoelectric from Guillian Woodpeker china RTA model with its internal irrigation system. We used US2 tip for lateral maxillary wall osteotomy and USIR tip for the posterior maxillary wall osteotomy. the pterygo-maxillary osteotomy done under endoscopic vision(fig.2).

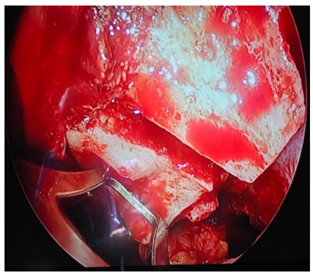

Fig.2 endoscopic-assisted pterygo-maxillary disjunction

The role of endoscope is to visualize this blind critical step in Lef1. When the maxilla is freely mobile in all directions it will be repositioned according to the previous pre-operative planning then fixed in the correct position with plates and screws(fig.3), (fig.4).

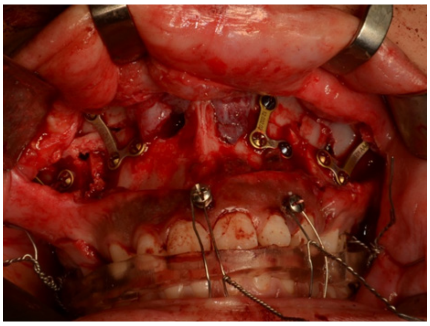

Fig.3 Plates and screw fixation

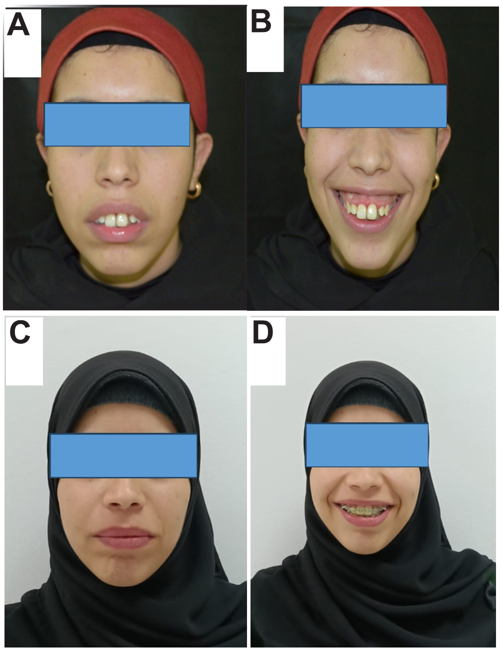

Fig. 4 A&B preoperative frontal view with upper lip in rest and smiling position. C&D post operative rest and smiling position respectively.

Results:-

The current study was conducted on 16 patients, divided equally into two groups, with each group consisting of 6 females and 2 males. The age distribution was from 20 to 30y with mean age 24y. Two parameters were evaluated to compare the two groups.

Parameter 1: the amount of blood loss:

	Group1(-control group) N%	Group2(study group) N%	T test	p-value	Sig.
Blood loss amount (ml) Mean ± SD Range	395±69.28 (300-500)	301.25±48.53 (250-400)	3.135	0.007*	HS

Table 1: *P value >0.05: non-significate (NS), P <0.05: significate (S), P <0.01: highly significate (HS).

Table (1) shows that there is statistically significant difference between group 1 and group 2 as the amount of blood loss (p=0.007).

Parameter 2: Time of operation

	Group1(con-trol group) N%	Group2(-study group) N%	T test	p-value	Sig.
Operation time (min) Mean ± SD Range	160±22.6 (130-200)	190±30.23 (160-240)	-2.245	0.041*	S

Table 2: *P value >0.05: non-significate (NS), P <0.05: significate (S), P <0.01: highly-significate (HS).

Table (2) shows that there is statistically significant difference between group 1 and group 2 as regarding operation time (p=0.041).

There was statistically significant difference between group 1 and group 2 in the amount of blood loss (p=0.007) as illustrated in table (1). Parameter 2: Time of operation: there was a statistically significant difference between group 1 and group 2 as regarding operation time (p=0.041) as illustrated in table (2)

Discussion:-

Orthognathic surgery is the cornerstone in treatment of skeletal deformities. The correction of maxillary skeletal deformities, utilizing various osteotomy techniques, tools, and fixation methods which continue to evolve. The ongoing advancements aim to introduce minimally invasive techniques and less traumatic osteotomy tools, enhancing healing and reducing intraoperative and postoperative complications [8]. In this study, we aimed to address the question: "Is MILF1 using a piezoelectric device under endoscopic vision superior to the traditional approach with a surgical saw and pterygoid osteotome in maxillary orthognathic surgery in terms of blood loss and osteotomy time?" Our hypothesis was that MILF1 would reduce intraoperative bleeding and complications compared to the traditional approach. This is attributed to the enhanced visibility provided by the endoscope and the fact that piezoelectric instruments are safer for soft tissue and vital structures than surgical saws[13, 14]. Regarding the time parameter based on evidence, hypothesis was that; piezo would require more time for osteotomy compared to a saw, although this was previously evaluated using different methods. In this research, we aimed to address these questions systematically [2] . In this study, the results for the study group demonstrated a significant reduction in blood loss compared to the control group.This reduction is attributed to the use of a small incision, enhanced visualization provided by the endoscope, and the advantages of piezoelectric surgery. These benefits were also been highlighted in previous studies[15]. The study also identified certain disadvantages, primarily related to the duration of the osteotomy in the study group. It was observed that MILF1 resulted in a significant increase in osteotomy time, averaging 30 minutes longer compared to the traditional approach (P<0.041P < 0.041P<0.041*). This finding regarding the extended operative time aligns with several previous studies that have evaluated the impact of piezoelectric surgery as an independent factor influencing osteotomy duration[16, 17].

Conclusion:-

The minimally invasive approach, utilizing a piezoelectric device under endoscopic vision, is more effective in reducing blood loss compared to the traditional approach. However, its drawback is that it requires more operation time.

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